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Abstract of bachelor's thesis

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Abstract

Value anomaly is one of the most studied topics of finance. Yet, enterprise multiples have been rarely used to study the value anomaly despite their prevalence in acquisition valuation. Further, cyclically-adjusted valuation multiples suffer from the same lack of attention, albeit their origins trace back to Benjamin Graham in the late 1930.

In this study, I fill the void and examine the value anomaly in U.S. stock market for the period 1984-2014 with cyclically-adjusted enterprise multiples. I form decile portfolios by sorting the investment universe upon EBIT/EV ratio and its cyclically-adjusted versions. The portfolios are rebalanced within three holding periods: 1-year, 2-years and 3-years. Subsequently, I examine the portfolios returns against risk.

EBIT/EV (and its cyclically-adjusted versions) based decile portfolios confirm the existence of value premium. However, I do not find that the cyclically-adjusted multiples produce greater value premiums than the conventional EBIT/EV ratio. The cyclically-adjusted ratios are able to find the best returning portfolios of study when the holding period is extended to two years. In risk-adjusted terms, the other top decile portfolios are superior to value portfolios across all the ratios.

Keywords value anomaly, value premium, relative valuation, enterprise multiple, cyclically-adjusted multiple, long-term multiple

Cross-Sectional Performance of Cyclically-Adjusted Enterprise Multiples

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Bachelor's Thesis, Finance

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1 Introduction

The possibility of finding a successful trading strategy is intriguing. This must part of the reason why stock market anomalies are one of the most studied subjects of finance. As a result CRSP and Compustat databases have been scrutinized to the extreme to come up with anomalies of which the most prominent must be value anomaly. Value anomaly is simple and seductive: buy stocks with low price-to-fundamental ratio and sell short those with high ratio. Even in all its simplicity, we still have two variables to worry about: price and a variable reflecting company's fundamentals. Consequently, studies are published where the appropriate choice of these two variables is made ostensibly complicated. This is one of those papers.

There is no limit to the variations of price-to-fundamental ratios that human mind can invent. Though, in the past research enterprise multiples have not been covered as extensively as equity multiples (i.e. P/E, P/B)[see [**Patari & Leivo 2017**] for literature review]. That is not to say there is not a study covering these, since there are a few using U.S. data [**Loughran & Wellman 2011**, **Grey & Vogel 2012**]. Another area that has not received as much line space is cyclically-adjusted multiples (or long-term multiples), albeit the origins of them trace back to Benjamin Graham in the late 1930 [**Graham & Dodd 1934**]. Lastly, bulk of the value anomaly studies are conducted with holding periods below or equal to one-year. Combining these three elements; enterprise multiples, cyclical-adjustment and holding periods above one-year, I find my chance to contribute to the existing literature.

In this study, I examine the value anomaly by sorting the investment universe upon EBIT/EV ratio, and its cyclically-adjusted versions, to decile portfolios (10%) with U.S. data in the period of 1984-2014. The cyclically-adjusted EBIT/EV ratios are constructed by using simple average of up to eight past years' EBIT observations in the numerator. I subsequently record the returns of these portfolios for three holding periods: 1-year, 2-year and 3-year. After each holding period ends, by turns, I repeat the process until I have the returns for the whole study period. With the return data and other statistics accumulated in the portfolio formation process, I am able to examine the value anomaly by comparing the decile portfolios' returns across the ratios and holding periods. In addition, I examine the decile portfolios' returns against risk. Three risk-adjusting frameworks are used: Sharpe ratio, Sortino ratio and Fama-French three-factor model. With these results I can provide a

complete view of the cross-sectional performance of cyclically-adjusted enterprise multiples.

The rest of the study proceeds as follows; first, I briefly introduce the theoretical framework, past research and practical concepts essential to the study. In Section 2, I describe the data used and discuss about the portfolio formation methodology. I find it necessary to spend some time in here to convince the reader about the credibility of the result. This is crucial especially since there are no further robustness checks provided. Section 3 presents the returns from the decile portfolios with tables, graphs and words. In section 4, I take the task to risk-adjust the returns. The study ends with a conclusion section and suggestions for further research.

1.1 Theoretical Framework

Anomalies are connected to the efficient market hypothesis. According to semi-strong form of market efficiency, prices are assumed to fully reflect all publicly available information [**Malkiel & Fama 1970**]. Financial statements are publicly available, and thus when formed properly an anomaly uses only publicly available information. The question is whether the returns from an anomaly are abnormal or not. When the returns are considered to be abnormal, the anomaly violates the semi-strong market efficiency.

Especially size and value anomalies have been persistent in the past. Later on, momentum anomaly has been documented as well. In a context of rational markets, the persistently higher returns can be seen as a proxy for risk. Series of papers by Fama and French formed the common anomalies (size and value) into an asset pricing model [**1992**, **1993**, **1995**, **1996**]. The riskiness of small and value stocks were reasoned by the persistently lower profitability [**Fama & French 1995.**] Subsequently, the momentum factor was included [**Carhart 1997**]. With a rational asset pricing model, the abnormality of given returns can checked against the model to see if the returns possess similar variation as the risk factors. However, the theoretical underpinnings of what constitutes the risk specific in these factors, are weak.

The alternative orientation to the anomalies is behavioral. Here, investors are not rational, but rather emotional decision makers with tendencies. The error-prone behavior has been documented by the performance of winner-loser portfolios [**DeBondt & Thaler 1985**, **1987**] and value-glamour portfolios [**Lakonishok et al. 1994**]. Also, going against the

crowd has paid off, as this strategy is able to exploit others' systemic errors in expectations [**La Porta 1996**]. In the behavioral framework the anomalies are inevitable consequences of investors tendencies and returns driven by both, risk and misvaluation [**Hirshleifer 2001**].

Thus, there exist two competing frameworks in which the results of this study could be assessed. In the rational framework, the difference between the returns of 10th and 1st portfolios (i.e. value premium) could be seen as the measure of efficacy of a given multiple's ability to distinguish risk. Correspondingly in the behavioral framework, existence of an anomaly can be seen as a profit opportunity arising from others mistakes.

1.2 Past Research

In general, value stocks are found by sorting the stock universe upon a reasonable price-to-fundamental ratio. Then, stocks are apportioned into portfolios according to this price-to-fundamental ratio. The portfolio containing the most lowly valued stocks is labeled as value portfolio, and thus stocks in this portfolio are value stocks. The opposite is true for growth portfolio. The value anomaly has evoked a concept of value premium which is defined as the return of a long-short portfolio, where value portfolio is bought long and the growth portfolio is sold short. Commonly, the portfolios are rebalanced on a yearly basis, and thus the value premium is measured as an annual return of the long-short portfolio over the study period.

Published studies covering the value anomaly are numerous and each end up with roughly the same conclusions: the anomaly is persistent. Hence, I find little value to hand pick a few of those to display the results here. I rather point the reader to Pätäri and Leivo's extensive review of value anomaly studies [**2017**]. Given the popularity of the topic, almost every reasonable price-to-fundamental ratio has been used to make inferences.

Yet, the value anomaly studies that use enterprise multiples to sort the stocks into portfolios are marginal subset of all the studies. Pätäri and Leivo found only five studies that used enterprise multiples of any form [**2017**]. Two of these were conducted with U.S. data. Loughran and Wellman found that EBITDA/EV based quantile portfolios produced 0.64% monthly value premium, using sample from 1963 to 2009 in U.S. [**2011**]. Similarly, Gray and Vogel sorted the U.S. investment universe into quantiles and found that portfolios formed upon EBITDA/EV yielded 17.66% annually for the period 1971 to 2010, and the value premium was 9.69%, respectively [**2012**].

Cyclically-adjusted valuation multiples have been well known for a long time. Cyclically-Adjusted-Price-Earnings ratio (CAPE), or sometimes called as the Shiller-PE, is used widely by the practitioners to appraise the whole markets' valuation level. The CAPE is based on Gampbell and Shiller's study, in which they show that the average of market's past 5 to 10 earnings divided by the whole market capitalization does a good job of predicting the returns for years to come [**1988**]. Anderson and Brooks tested the concept on individual stock level in U.K. for the period 1975-2013, and found that that value premium did increase when a cyclically-adjusted P/E was used to form the decile portfolios instead of the conventional P/E [**2006**]. Further, Anderson and Brooks tested different rebalancing periods up to 8 years and found that as the rebalancing period was extended, the returns decreased across the deciles. Due to the significance of momentum, shorter rebalancing periods (less than a year) have been found to perform the best as illustrated by Asness and Frazzini [**2013**]. Gray and Vogel tested the cyclically-adjusted EBITDA/EV with quantile portfolios, but found no evidence of increasing value premium with years of EBITDA used in the numerator (same study as above [**Grey & Vogel 2012**]).

1.3 Doctrines of Practitioners

In this subsection, I enrich the academic insight displayed above with the ideas from practice.

The formulation of the mechanical value strategy much resembles the concepts of value investing as initiated by Benjamin Graham [**Graham & Dodd 1934**]. Graham was an advocate of using the average of past earnings over a business cycle when appraising earnings power of a company. Earnings power refers to permanent earnings that the company could sustain when facing competitive pressures [**Graham & Dodd 1934**, **Graham 1949**]. It is an intuitive idea to average out the past profitability when estimating future. This way, the noise in estimate is reduced due to single year's exceptional profit.

The enterprise multiples are widely used in valuing acquisitions and private equity transactions. The benefits of using them arises from the comparability of firms across different leverage and, accounting and tax methods. Often an acquirer is not interested in the impact of leverage, accounting policies and taxes since it generally assumes the debt and integrates the acquisition under its own accounting and tax policies. Enterprise multiples might be better at capturing the value of small publicly listed companies since they are likely to be

takeover targets.

2 Data and Methodology

The study relies heavily on the data manipulation done in R programming language. To give the reader complete and fair view of the choices I have made regarding the formation of the decile portfolios, I will describe the rationales for my choices thoroughly.

2.1 Description of The Data

The data for the study is collected from Wharton Research Data Services (WRDS) for the period 1984 to 2014. From WRDS, two sources are used: CRSP Stock Monthly and CRSP-Compustat Merged (CCM). CRSP Stock Monthly contains month-end prices on primary listings for the NYSE, NYSE MKT, NASDAQ, and Arca exchanges. CRSP-Compustat Merged (CCM) contains fundamental data updated annually for North America listed companies. The two databases are merged by PERMNO which is the permanent issue identifier assigned by CRSP.

Firstly, I have done the data cleaning primarily as Fama and French have [**1992**, **1993**, **1995**, **1996**]. The data is filtered by Share Code (SHRCD) to exclude ADRs, closed-end funds, foreign companies and REITs since the focus is solely on U.S. stocks. In addition, companies with negative market capitalization and with more than one type of share (i.e. voting and non-voting) are excluded. Apportioning profit between the share classes would be problematic and lead to double-counting of financials reflecting the same economic reality. Each year I have excluded the smallest decile (10%) by market capitalization from the investment universe to ensure adequate liquidity for a relevant market participant. This is less conservative than Fama and French's method, but is the same practice as used by Gray and Vogel [**2012**]. Also, as a premise to compare the cyclically-adjusted valuation multiples, the investment universe has been restricted to include only those companies with full eight years of consecutive EBIT observations. If this was not the case, the portfolios formed upon, say, using past three years and past eight years EBITs would have different investment universes, and thus I could not distinguish if a given multiple is truly more efficient or is the investment universe just more favorable. This is a convention when studying cyclically-

adjusted multiples [**Anderson & Brooks 2006**, **Gray & Vogel 2012**]. The returns used in this study include dividends and other cash payments. Further, the returns are handled as cumulative percentage returns.

I have decided to use EBIT as the variable to gauge company's profit. The choices here are plenty. Close substitutes for EBIT include earnings, operating profit and Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), each with their pros and cons. However, in context of enterprise multiples, EBITDA and EBIT are more common than the others. Further, the main difference between equity multiples and enterprise multiples is that the latter proportion the profit to all obligations of an enterprise. To come up with an enterprise value, I have used similar definition as the past researchers [**Loughran & Wellman 2011**, **Gray & Vogel 2012**]. Enterprise value is:

$$EV = ME + Debt + PreferredStock - Cash \tag{1}$$

where EV is enterprise value, ME is market capitalization, $Debt$ is constructed from two Compustat variables Short-term debt (DLC) and Long-term debt (DLTT), $PreferredStock$ is the value of company's issued preferred stock (PSTKRV) and $Cash$ is Cash plus short-term investments (CHE). Hence, the enterprise multiple using EBIT is:

$$\frac{EV}{EBIT} \tag{2}$$

where $EBIT$ is retrieved from Compustat as such .

2.2 Formation of The Decile Portfolios

The decile portfolios are the core of this study. Hence, the way they are formed plays crucial a role in determining the credibility of the results. I find it convenient to describe the portfolio formation in terms of the necessary lags and leads in the price and fundamental data, respectively.

In studies like this one, where the objective is to repeat the past in a certain way, it is of first-order importance to avoid data-snooping. That is, the information used to form the portfolios should have been available to investors at the time. Compustat assigns a firm's

annual report data on an arbitrary date, which is not necessarily the publication date. Datawise this constitutes a problem, since now matching CRSP and Compustat databases simply by date is not an option. I have handled the fundamental variables as follows: (i) I match the databases by date and then postpone each fundamental variable observation by four months, (ii) this date serves as the presumptive publication date, (iii) then I fill the months in between the presumptive publication dates with the preceding fundamental variables.

Hence, I allow four month gap between the date of fundamental variables and the price quote of a stock, used subsequently to calculate market capitalization. In terms of the valuation multiple, the situation looks like this:

$$\frac{ME_t + Debt_{t-4} + PreferredStock_{t-4} - Cash_{t-4}}{EBIT_{t-4}} \tag{3}$$

which I get by combining equations (1) and (2). Note that the subscript of ME is t in contrast to the other variables.

Now that the data behind the multiples is adjusted properly, I can construct the valuation multiples to form the decile portfolios. Valuation multiples are commonly defined in form of price-to-fundamental. But in the context of statistical studies, using the inverse, fundamental-to-price, is more practical since placement of negative numbers is more intuitive. Thus, from now on I shift to use the term valuation ratio. Each year at the last day of June, EBIT/EV ratios are calculated for every stock included in the universe. For each stock, eight ratios are calculated by using average of past n EBIT observations. The ratios are defined as follows:

$$EBIT(n)/EV_i = \frac{\sum_{j=1}^{n} EBIT_{ij}}{nEV_i} \tag{4}$$

where $EBIT_{ij}$ is the Earnings Before Interest and Taxes for company i for j years ago, EV_i is the enterprise value of company i as defined in equation (1) and n is the number of years of $EBIT$ used in the ratios' calculation. Since the ratios are calculated using up to eight years average of $EBIT$, $n = 1, 2..., 8$.

Note that technically, the valuation ratios are constructed by taking the simple average of past n EBIT observations. Yet, economically the most recent EBIT observations are

implicitly weighted more heavily because of the existing inflation during the period. This, thought, does not alter the results much as pointed by Gray and Vogel [**2014**].

The stocks are sorted into deciles in ascending order based on their EBIT/EV ratios. Stocks with the lowest EBIT/EV ratios are in the first decile and stocks with the highest EBIT/EV ratio are in the tenth decile. First and tenth decile are named as growth and value portfolios, respectively.

I allow another four month gap between sorting the stocks into portfolios and starting to record the returns of the portfolios. In practical terms, this equals a gap between selecting the stocks to buy and actually buying them. Generating the gap is necessary to ensure unbiasedness of the returns, since it secures that the dividend returns are treated properly. At the last day of October, 1984 the portfolios are bought and in the later years rebalanced. As there are eight valuation ratios, 80 portfolios are formed for a given holding period. The portfolios are bought for three holding periods: 1-year, 2-year and 3-year. Thus, every sixth year 240 portfolios are bought. For each valuation ratio, a corresponding long-short portfolio is formed by buying long the value portfolio and selling short the growth portfolio. All of the portfolios are equally weighted. This simplifies the computation since a portfolio's return is the average of its stocks' returns. No owner initialized transactions occur during the holding periods. Figure 1 illustrates the portfolio formation timeline.

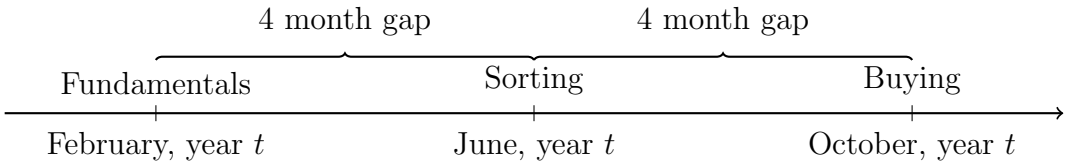


Figure 1: Portfolio formation timeline

2.3 Caveats

Although the efforts to ensure an unbiased investment universe, still several caveats loom in the details. I have not adjusted the CRSP returns for delistings as suggested by Shumway [**1997**]. This leads to upward biased returns, particularly in case of small stocks, as the delisting returns predominantly require downward adjustments to CRSP returns. Also, the prerequisite of eight consecutive EBIT observations is likely to lead the investment universe

towards more stable companies, and thus cause a likewise upward bias in the returns. The combined effect of these is not examined more specifically in this study.

Further, the portfolio formation timeline deserves a critical review. My approach to the timeline is much less conservative than has generally been in the past research. It has been a custom to match the fundamental data and price observations for the same date, and allow at least a half-year gap between sorting the portfolios and buying them [**Fama & French 1992**, **1993**, **1995**, **1996**]. Asness and Frazzini pointed that this set-up of the timeline is sub-optimal, since the price is known with certainty at the date of portfolio formation [**2013**]. I base my decision to delay the fundamental variables by four months on the average difference between Compustat variables Date and Preliminary date (PDATE).[1]

3 Results

3.1 Returns of The Decile Portfolios: Yearly rebalancing

In this section I report the annual returns of the yearly rebalanced decile portfolios. Average annual geometric returns of the portfolios are presented in Table 1 (Panel A). From the results, I can confirm that the value premium exist. In the first column of Table 1 (Panel A), the decile portfolios are formed upon EBIT/EV. The growth and value portfolios returned annually 8.19% and 14.67%, respectively. The last row displays the value premiums. The EBIT/EV based long-short portfolio returned 6.48% annually. These returns are inline with returns found by Gray and Vogel [**2014**], 8.10% and 16.22% for growth and value, respectively, when they formed the portfolios upon EBITDA/EV for the period 1973-2013.[2] Columns after the first are portfolios formed upon the cyclically-adjusted EBIT(n)/EV ratios (where the EBIT indexation n tells the years of observations used in the average calculation). The value premium exist for each of the cyclically-adjusted ratios as well. The best return for a value portfolio is recorded by sorting the universe upon EBIT(8)/EV ratio. However, the best performing portfolio is not a value portfolio, but the 9th decile portfolio when sorting

[1]Preliminary date is generally assumed to be better proxy for the actual publication date. The conclusion has been drawn by comparing the Preliminary date to IBES database's annual report end dates. Unfortunately, Preliminary date is not available for most of this study's period.

[2]Gray and Vogel's [**2014**] setup is similar to mine, with the exception that they have included only companies above the 40th percentile breakpoint by market capitalization (yearly) to the investment universe.

is done by EBIT(7)/EV with a 15.13% annual return.

Scrutinizing Table 1 (Panel A) diagonally, the hypothesis of conventional value premium increasing as years of EBIT used in the numerator increases, breaks down. I can not find the increasing value premium that Anderson and Brooks [**2006**] found with U.K. data. In fact, the greatest value premium is not found by using a cyclically-adjusted ratio, but rather the non-adjusted ratio (6.48%). Although, the pattern of value premium, from left to right, first decreasing and then increasing towards the eight year might suggest that using more than eight years average of EBIT would eventually lead to greater value premium from the cyclically-adjusted ratios.

The reason I used the term conventional value premium is found on the first and second rows of Table 1 (Panel A). The returns from first (growth) and second deciles differ substantially across the ratios. With out an exception, the worst performing portfolio is the second decile. To my knowledge, this is an uncommon finding, and thus is likely to be sample specific due to the extensive restrictions in the data as discussed above. Risk aside, an investor would be better-off by shorting the second decile portfolio rather than the growth portfolio in her value premium strategy. Hence, this gives rise to unconventional value premium, where the second decile is shorted instead of the growth portfolio.

Table 1: Annually Formed Decile Portfolios, 1984-2014

This table presents the annual formed decile portfolios. **Panel A** tabulates the annual geometric mean return of the portfolios. **Panel B** tabulates the median valuation ratios across all of the portfolios formed upon a given valuation ratio for the study period. The portfolios are formed using EBIT/EV ratio and the cyclically adjusted EBIT(n)/EV ratios (where n denotes the average of past n years' EBIT) to sort the investment universe into deciles. The portfolios are rebalanced yearly. First and last deciles are named Growth and Value, respectively. The investment universe contains U.S. listed common stocks. The universe is filtered yearly to include only those stocks with market capitalization over the 10th percentile. The portfolios are studied from 1984 to 2014.

	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel A: Annual Geometric Mean Returns (%)								
Growth	8.19	9.03	8.89	9.53	9.74	8.90	8.55	8.48
2nd	6.31	5.16	5.52	5.08	4.89	5.10	5.00	5.46
3rd	9.56	9.69	9.94	9.11	9.73	9.69	10.09	9.18
4th	10.82	11.14	10.38	11.14	10.90	11.71	11.10	11.55
5th	11.94	10.79	11.20	11.52	12.32	13.08	13.67	12.85
6th	11.39	12.78	13.11	13.04	13.18	13.07	12.51	12.40
7th	13.89	13.78	13.73	13.62	13.04	12.40	12.97	14.00
8th	14.44	14.08	13.98	14.37	13.36	13.35	13.06	12.75
9th	14.64	15.05	15.04	14.38	14.63	14.49	15.13	14.86
Value	14.67	14.51	14.49	14.49	14.51	14.50	14.26	14.71
10th-1st	6.48	5.48	5.60	4.96	4.77	5.60	5.70	6.23
	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel B: Median Valuation Ratios								
Growth	−0.123	−0.108	−0.096	−0.092	−0.081	−0.076	−0.071	−0.062
2nd	0.000	−0.001	0.002	0.002	0.002	0.003	0.004	0.004
3rd	0.035	0.033	0.032	0.031	0.029	0.029	0.029	0.028
4th	0.055	0.052	0.050	0.049	0.047	0.045	0.044	0.042
5th	0.068	0.064	0.063	0.060	0.058	0.057	0.055	0.053
6th	0.080	0.077	0.074	0.072	0.069	0.067	0.065	0.063
7th	0.094	0.089	0.086	0.084	0.084	0.080	0.078	0.075
8th	0.108	0.102	0.099	0.098	0.096	0.095	0.092	0.090
9th	0.128	0.124	0.122	0.120	0.118	0.118	0.115	0.112
Value	0.196	0.190	0.179	0.176	0.171	0.170	0.169	0.175

What is about the second decile portfolios that make them perform worse than the first decile portfolios? Table 1 (Panel B) sheds a light on the characteristics of the stocks in each portfolio. The median EBIT(n)/EV ratios, upon which the portfolios were formed, are tabulated for each portfolio across the study period. As they should, each column demonstrates a neat ascendant sequence from top to bottom. What is captivating to notice, stocks with negative valuation ratios are limited to the first decile and the median valuation ratio of stocks in the second decile are barely positive.[3]

Here, I find similarity with the contrarian narrative recognized by the behavioral research. The abnormal performance of contrarian strategies might be due to investors not appreciating the mean-reverting characteristics of firms' fundamentals. This leads to situation where the best performing stocks are the most sought after. Correspondingly, the worst performing stocks are ditched as unpopular. Numerous of studies have observed this phenomenon (see [**Lakonishok et al 1994; DeBondt & Thaler 1985**, **1987**]). Since in this study the investment universe includes only stocks with eight consecutive EBIT observations, the typical growth firms, going through the early unprofitable period, are nonexistent. Hence, the growth portfolio is likely contain the least popular stocks with contrarian characteristics rather than growth stocks. This changes the story drastically since now the portfolio that should represent the highest (growth) expectations, represents de facto the lowest expectations. Rationalizing like this, the unconventional value premium being higher than the conventional makes sense.

3.2 Returns of The Decile Portfolios: Longer Rebalancing periods

In this section I report the annual returns of the 2-year and 3-year rebalancing period decile portfolios. The portfolios rebalanced once in every two and three years confirm the existence of value premium as well. The annual geometric average returns from 2-year rebalancing period portfolios and 3-year rebalancing period portfolios are shown in Table 2, within Panel A and B, respectively. The value premium is generally weaker with longer holding periods. However, the greatest value premium of this study is found from the last column of Panel A. Sorting the universe upon EBIT(8)/EV with 2-year rebalancing period returned an annual

[3]There are several reasons why the median might not characterize the underlying stocks precisely, but for the purposes in here, it serves as a reasonable proxy for the contents of the portfolios.

long-short return of 6.78%. The same method was also able to find the best performing portfolio of the study: biyearly rebalanced portfolio formed upon EBIT(8)/EV ratio returned 16.77% annually. Regardless the information gained from these, the most meaningful part of Panel A is the far enhanced performance of value portfolios compared to the yearly rebalanced value portfolios. Each of the value portfolios' returns improved when the rebalancing period extended to 2-years, and the magnitude grew with the years EBIT used in the ratio. For example, the EBIT(8)/EV value decile's returns were 14.71% and 16.77% for 1- and 2-year rebalancing periods, respectively. It is also noteworthy that rebalancing biyearly, growth portfolios performed better than second and third decile portfolios across all ratios. This further supports the contrarian narrative.

The 3-year holding period portfolios in Panel B are a mixed bag. The returns across all of the portfolios seem to converge to the market return and subsequently value premiums are weak. In contrast to yearly and biyearly rebalanced portfolios, with 3-year holding period the value portfolio is the best performing only when the stocks are sorted by EBIT(8)/EV.

The evidence suggest that undervalue may take longer time to be found than overvalue. However, the time it takes the market to correct itself comes rather quickly, as the value is lost during the shift from two to three year rebalancing period.

Table 2: Decile Portfolios With Longer Reblancing Periods, 1984-2014

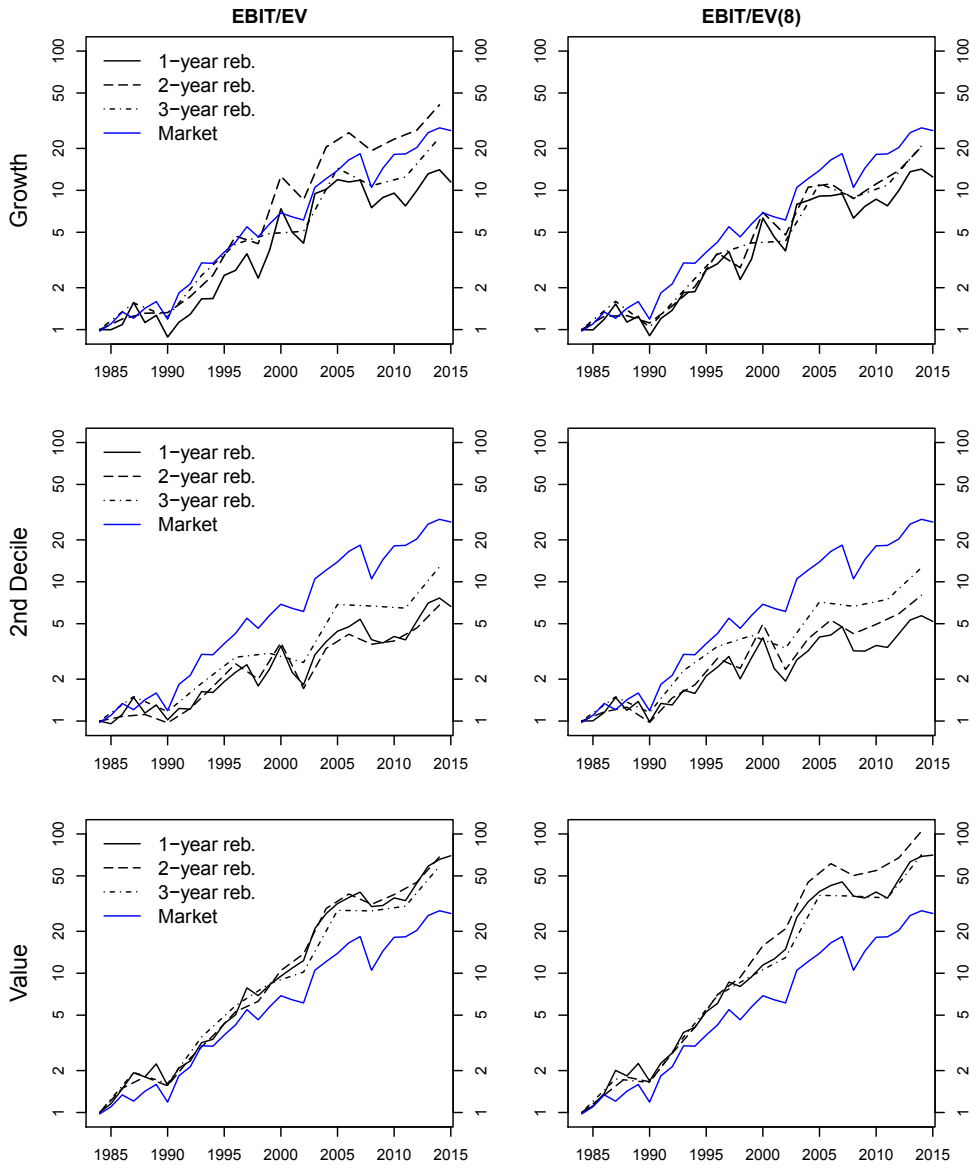
This table presents the returns from decile portfolios with rebalacing periods of 1- and 2-years. **Panel A** tabulates the annual geometric mean return of the portfolios rebalanced once in every two years. **Panel B** tabulates the annual geometric mean return of the portfolios rebalanced once in every three years. The portfolios are formed using EBIT/EV ratio and the cyclically adjusted EBIT(n)/EV ratios (where n denotes the average of past n years' EBIT) to sort the investment universe into deciles. First and last deciles are named Growth and Value, respectively. The investment universe contains U.S. listed common stocks. The universe is filtered yearly to include only those stocks with market capitalization over the 10th percentile. The portfolios are studied from 1984 to 2014.

	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel A: Two-Year Rebalancing Period (%)								
Growth	13.19	12.65	11.52	12.17	12.38	11.37	11.35	10.60
2nd	6.60	6.74	8.09	7.11	6.95	6.70	6.14	7.18
3rd	10.73	10.47	9.75	9.92	10.10	10.98	10.90	9.93
4th	11.35	11.19	12.06	12.55	13.20	13.80	12.97	13.75
5th	14.40	12.47	12.91	13.32	13.02	13.22	13.56	13.50
6th	12.61	14.27	12.59	13.32	14.40	13.72	14.22	13.55
7th	13.55	14.31	14.28	14.50	13.28	13.56	14.01	14.61
8th	14.03	13.82	15.16	13.79	13.59	13.46	12.91	12.62
9th	14.87	15.48	15.19	14.60	13.84	14.03	14.81	14.51
Value	15.13	15.18	15.55	15.88	16.34	16.36	16.31	16.77
10th-1st	2.19	2.84	4.48	4.15	4.43	5.53	5.50	6.78
	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel B: Three-Year Rebalancing Period (%)								
Growth	11.16	11.14	11.69	11.61	11.19	11.19	11.02	10.66
2nd	8.87	9.62	8.64	8.72	8.84	8.06	8.21	8.82
3rd	10.13	10.41	10.81	11.35	11.48	11.35	11.15	10.61
4th	11.68	11.30	11.99	11.23	11.36	12.54	11.86	12.72
5th	13.19	12.94	12.32	12.56	13.23	12.77	13.41	12.48
6th	12.34	13.38	12.45	13.27	13.71	13.40	12.98	12.68
7th	13.04	12.48	13.51	13.80	12.77	13.38	13.37	13.64
8th	13.80	14.10	14.49	13.69	13.80	14.19	13.50	13.98
9th	15.73	14.76	15.06	14.50	14.51	14.25	15.27	13.90
Value	14.54	14.71	13.73	13.97	13.88	13.69	13.99	15.26
10th-1st	4.13	4.37	2.52	2.92	3.30	3.06	3.62	5.56

3.3 Graphical Presentation of Selected Strategies

Slightly better annual return leads to substantial difference in the capital over years. Figure 2 plots selected portfolios on a 3x2 matrix.

Figure 2: A Dollar of Investment in Selected Strategies, Log-Scale



The figure plots a dollar of investment performance over 1984-2014 for selected strategies. Left column plots the non-adjusted ratio portfolios and right column plots the portfolios formed on EBIT(8)/EV. Rows plot growth, second decile and value portfolios. Lines correspond to rebalancing periods as shown in legend(s). The market return is equally-weighted U.S. market performance including cash adjustments.

4 Risk Adjusted Returns

Arriving to this section, I do not assess the risk-reward characteristics of the portfolios with 2- and 3-year rebalancing periods. There are two reasons for this; (i) the yearly rebalanced portfolios' value premiums are superior to the 2- and 3-year rebalancing period value premiums and (ii) the way I have setup the data does not allow an accurate treatment of returns over 1-year period.

The portfolios' returns by themselves are meaningless. To get the complete picture of how the portfolios performed, it is necessary to adjust the returns for the risk they bore. Risk is an elusive concept and it might take different forms in different times and situations. Here, I take three routes to discover risk-adjusted returns. First there are two practical reward-to-risk ratios in form of Sharpe and Sortino. Then, I regress the returns of selected portfolios on the Fama-French 3-factor model to see if the returns are merely from exposure to their risk factors.

4.1 Sharpes and Sortinos

The Sharpe ratio as an ex-post measure is defined as follows:

$$SR_i = \frac{R_i - R_f}{\sigma_i} \tag{5}$$

where R_i is the (arithmetic) average of the realized returns for a portfolio i, R_f is the average risk-free rate and σ_i is the sample standard deviation of portfolio i's returns. The risk-free rates for this and subsequent use are retrieved from Kenneth French's homepage.[4]

Another reward-to-risk ratio is the Sortino ratio. Where the risk in Sharpe's denominator is deviation - be it upside or downside - Sortino consider only downside deviation as a risk to be concerned about. Sortino ratio takes an user input of minimum acceptable return (MAR) [**Sortino & Price 1994**]. Here, I set $MAR = 0$, and the Sortino ratio reduces as:

$$SoR_i = \frac{R_i}{DR_i} \tag{6}$$

[4]The Fama-French factors are also retrieved from Kenneth French's homepage. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

where DR_i is semideviation defined as:

$$DR_i = \sqrt{\frac{1}{N}\sum_{t=1}^{N}(min\{0, r_{i,t} - \overline{r}_i\})^2} \tag{7}$$

of which the *min* function construction can be recognized as the device concerning only about downside variation. Further, R_i is defined as in Sharpe ratio. The ratios are calculated by using annual return data.

Table 3 shows the Sharpe and Sortino ratios for the annually rebalanced portfolios in Panels A and B, respectively. Across the valuation ratios, none of the value portfolios have the best Sharpe ratio relative to the other deciles. In fact, in each column value portfolio ranks third or lower by Sharpe ratio. Note that in Table 1 (Panel A), the yearly rebalanced value portfolios ranked at least second on every ratio by returns. The difference in ranks rises from the value portfolio having higher standard deviation of annual returns than the other top decile portfolios. The most desirable risk-to-reward trade-offs are found from the ninth decile portfolios across the ratios. The best portfolio based on Sharpe ratio was the ninth decile portfolio formed upon EBIT(7)/EV. Also, the bottom row of Panel A indicates that the long-short portfolios' returns were inferior to risk-free rate.

The Sortino ratios tell the same story and in fact the exact same portfolio has the best Sharpe and Sortino ratios. The Sortino ratio results shatter common belief that the value stocks would have lower downside risk. Although the notion that lower valuation goes hand in hand with lower risk is seductive, I cannot find evidence supporting this belief. Similar results have been found by Gray and Vogel [**2014**]. Continuing the contrarian narrative, the case of the growth portfolios would have taken root had the growth portfolios' Sortinos told a more favorable story than Sharpe ratios. Yet, this is not the case and I can conclude that based on the results here, the contrarian portfolios (disguised as the growth portfolios) are not associated with distinctive downside deviations.

Both of the reward-to-risk ratios provide clear and coherent statistics against the case that value portfolios are the best bet for investors. While the evidence is believable, further separation of value and market capitalization should be done to say that results are due to value over size.

Table 3: Reward-to-Risk Ratios of Annually Formed Decile Portfolios, 1984-2014

This table presents reward-to-risk ratios for the annual formed decile portfolios. **Panel A** tabulates Sharpe ratios of the portfolios. **Panel B** tabulates Sortino ratios of the portfolios. Both of ratios are computed using the yearly standard deviation of returns. The portfolios are formed using EBIT/EV ratio and the cyclically adjusted EBIT(n)/EV ratios (where n denotes the average of past n years' EBIT) to sort the investment universe into deciles. The portfolios are rebalanced yearly. First and last deciles are named Growth and Value, respectively. The investment universe contains U.S. listed common stocks. The universe is filtered yearly to include only those stocks with market capitalization over the 10th percentile. The portfolios are studied from 1984 to 2014.

	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel A: Sharpe Ratios								
Growth	0.255	0.281	0.277	0.295	0.301	0.275	0.266	0.265
2nd	0.209	0.165	0.182	0.166	0.157	0.168	0.161	0.180
3rd	0.358	0.362	0.379	0.340	0.375	0.370	0.389	0.346
4th	0.459	0.478	0.446	0.480	0.461	0.518	0.495	0.514
5th	0.573	0.500	0.500	0.531	0.561	0.599	0.622	0.580
6th	0.562	0.601	0.635	0.608	0.605	0.590	0.569	0.579
7th	0.677	0.679	0.678	0.642	0.635	0.605	0.631	0.677
8th	0.702	0.696	0.666	0.695	0.646	0.636	0.633	0.599
9th	0.689	0.703	0.707	0.722	0.708	0.722	0.725	0.719
Value	0.618	0.605	0.616	0.606	0.612	0.603	0.594	0.615
10th-1st	−0.031	−0.058	−0.052	−0.076	−0.084	−0.041	−0.036	−0.015

	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Panel B: Sortino Ratios								
Growth	0.941	1.031	1.024	1.097	1.123	1.056	1.008	0.985
2nd	0.741	0.603	0.630	0.580	0.565	0.571	0.573	0.620
3rd	1.247	1.199	1.277	1.170	1.248	1.211	1.241	1.118
4th	1.682	1.803	1.671	1.808	1.752	1.992	1.912	1.911
5th	2.223	1.874	1.799	1.969	2.041	2.319	2.407	2.201
6th	2.102	2.390	2.455	2.236	2.384	2.192	2.090	2.174
7th	2.682	2.606	2.577	2.445	2.458	2.433	2.499	2.931
8th	2.784	2.660	2.554	2.900	2.446	2.502	2.487	2.159
9th	2.748	2.795	2.784	2.830	2.836	2.859	3.091	3.135
Value	2.325	2.347	2.522	2.464	2.456	2.452	2.386	2.547
10th-1st	0.157	0.152	0.172	0.140	0.127	0.177	0.180	0.210

4.2 Three-Factor Alphas

I regress the portfolios' excess returns on the Fama-French three-factor model. The model is defined as follows:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i(r_{m,t} - r_{f,t}) + s_i SMB_t + h_i HML_t \tag{8}$$

where $r_{i,t}$ is portfolio i's return on period t, $r_{f,t}$ is the risk free rate, $r_{m,t} - r_{f,t}$ is market's excess return on period t serving as the market factor, SMB_t and HML_t are risk factors for small stock exposure and value stock exposure, respectively. α, β, s and h are coefficients of the regression. Working with small sample size (annual returns), I am not able to find statistically significant alphas. Regardless, the three-factor alphas and corresponding t-statistics are shown in Table 4.

Table 4: Three-Factor Alphas (%) of Annually Formed Decile Portfolios, 1984-2014

This table presents annual three-factor alphas for selected annually rebalanced decile portfolios.

	EBIT	EBIT(2)	EBIT(3)	EBIT(4)	EBIT(5)	EBIT(6)	EBIT(7)	EBIT(8)
Growth	−0.30	0.29	0.41	1.15	0.80	0.42	0.10	−0.03
	(−0.05)	(0.05)	(0.07)	(0.19)	(0.14)	(0.07)	(0.02)	(0.00)
2nd	−3.46	−4.45	−4.12	−5.10	−4.98	−5.04	−5.10	−3.94
	(−0.85)	(−1.18)	(−1.05)	(−1.41)	(−1.38)	(−1.34)	(−1.39)	(−1.07)
9th	3.74	3.81	4.06	4.28	3.89	3.82	4.48	4.36
	(1.22)	(1.24)	(1.31)	(1.45)	(1.29)	(1.32)	(1.44)	(1.41)
Value	3.05	3.30	3.46	3.32	3.64	3.51	3.23	3.64
	(0.85)	(0.90)	(0.98)	(0.92)	(0.99)	(0.93)	(0.86)	(0.97)
D1-D10	−0.54	−0.88	−0.83	−1.72	−1.05	−0.79	−0.76	−0.22
	(−0.12)	(−0.21)	(−0.21)	(−0.45)	(−0.28)	(−0.21)	(−0.20)	(−0.06)

Notes: $Samplesize = 30$. $Df = 26$, Two-tail t values [level]: 2.78 [0.01], 2.06 [0.05], 1.71 [0.1]
T-statistics: $\alpha/s.e.(\alpha)$ (on parentheses).

5 Conclusion

In this study, I examined the performance of cyclically-adjusted enterprise multiples. I found that all of the decile portfolios formed upon EBIT/EV ratio and the cyclically adjusted versions of it were able to generate positive value premium (i.e. value long, growth short portfolio performance). In general, the portfolios returns increased through the deciles (from growth to value), but not monotonically. On the yearly rebalanced portfolios, I did not found that the cyclical-adjustment would have enhanced the value premium. In fact, the greatest value premium was discovered by the non-adjusted ratio. Also, my findings suggest that when the investment universe is as restricted as it tends to be with cyclically-adjusted ratios, the growth portfolio does not meet the expectations of the worst performance. With every ratio, the worst performing portfolio was the second decile portfolio. This finding supports the contrarian case of performance reversal and gives arise to unconventional value premium, where the second decile portfolio is sold short instead of the growth portfolio.

On the longer rebalancing periods, the performance of value portfolios were substantially enhanced by rebalancing the portfolio only once in two years. The magnitude of improvement grew with the years of EBIT used in the ratio. This suggest that undervalue takes more than one year to uncover. The three-year rebalancing period portfolios were weak in terms of the value premium they generated.

The risk-adjusted returns were not in favor of value portfolios. The value portfolios had higher volatility and downside volatility than the other top decile portfolios. Across the ratios, the best risk-adjusted performance was found from the ninth decile portfolio.

The study suggest that further research could done with the cyclically-adjusted multiples. Restricting the investment universe only to companies with a longer history of being listed might find the contrarian characteristics better.

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